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Short Communication

Are cultural ecosystem services expressed in school songs associated with nature-related educational activities?

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Abstract

Cultural ecosystem services (CES) are increasingly recognized not only for their symbolic and experiential values but also for their potential to shape human behavior. Song lyrics incorporate natural motifs; however, these references are often generic and not tied to specific places, raising questions about their ability to foster place-based attachment or local engagement with the ecosystems. School songs are institutionally embedded and repeatedly performed within defined communities, which could be making them reinforce local ecological identity. This study examined whether ecological terms in school songs are associated with nature-related education activities. We focused on public elementary and junior high schools in Hachioji City, Tokyo, where Mt. Takao represents a dominant natural landmark. The lyrics of school songs were collected, and keywords related to mountains were extracted. Information on nature-related educational activities was obtained through a questionnaire survey of schools, with valid responses from 63 schools. A statistical test was conducted to determine whether schools with mountain-related terms in their songs were more likely to conduct nature-related educational activities. Results indicated that schools whose songs contained mountain-related terms had educational programs using local green spaces more often than those without such terms. This finding suggests that cultural representations embedded in school traditions may influence educational practices. Our study suggested that CES expressed through place-specific song lyrics can mediate concrete human-nature interactions.

Key words: Ecosystem service, educational activities, human-nature relationship, music, school song

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Introduction

Cultural ecosystem services (CES) encompass the non-material benefits that people derive from nature, including recreation, aesthetic appreciation, spiritual values, and the formation of cultural identities (Chan et al. 2012; Milcu et al. 2013; Whitburn et al. 2020). Beyond their symbolic and experiential dimensions, CES are increasingly recognized for their capacity to shape human attitudes and behavior (Osawa et al. 2020; Whitburn et al. 2020). For example, place attachment and identity derived from cultural interactions with ecosystems have been shown to motivate pro-environmental actions and conservation practices (Whitburn et al. 2020). Thus, cultural values

could influence not only human-nature relationships but actively boost conservation efforts.

Music provides a lens through which ecological elements are culturally represented (Publicover et al. 2018; Katayama and Baba 2020; Bamle 2024; Wang et al. 2025). For example, Katayama and Baba (2020) demonstrated that references to ecosystem types or taxonomic groups in old song lyrics represent a form of CES that embeds ecological motifs into artistic inspiration. Publicover et al., (2018) argued that music is one of the most effective tools for environmental education for enhancing environmental consciousness. However, such references in popular songs or general compositions are often generic and not bound to a specific locality, raising questions about their ability to foster a strong place-based attachment or stimulate localized environmental behaviors.

Place attachment is critically important in conservation activities. For example, Kuo et al. (2021) demonstrated that place attachment and place identity exert positive effects on pro-environmental behavior (Kuo et al. 2021). Meta-analyses have also shown that place attachment is positively associated with conservation behavior (Daryanto and Song 2021). School songs are inherently tied to particular institutions and are performed repeatedly within specific communities. Their lyrics frequently incorporate natural symbols from the surrounding landscape (Tebakari et al. 2020). As such, school songs may reinforce local identity, strengthen emotional bonds with nearby ecosystems, and translate into tangible behaviors, such as incorporating local nature into educational activities, outdoor learning, and community engagement.

This study addressed the following research question: Are ecological symbols in school songs associated with the implementation of nature-related educational activities in schools? More specifically, we examined whether references to mountains in school songs are related to nature-related educational activities. As a case study, we examined the relationship between school songs and nature-related education activities such as the use of nearby green spaces in elementary and junior high schools in Hachioji City, Tokyo, Japan. Hachioji City is home to Mt. Takao, which serves as a local symbol and plays an important role in the culture, history, and tourism of the region (Zakaria et al. 2021). Therefore, particular attention was given to lyrics related to mountains and associated activities. By examining this relationship, we highlight how CES can influence not only values and perceptions but also concrete behavioral outcomes in educational and community settings.

Methods

Study area and research subjects

The study was conducted in Hachioji City, Tokyo, Japan (Fig. 1). Hachioji is a core city located in the western area of Tokyo, with a population of approximately 560,000 (https://www.city.hachioji.tokyo.jp/hachiouji/jinko/003/p035395.html, accessed 25, Sep., 2025). Although both public and private schools are located within the city, students at private schools often commute from outside Hachioji, whereas public schools have designated school districts. In particular, elementary and junior high schools are attended in principle by children residing within the corresponding districts. Therefore, we assumed that the local

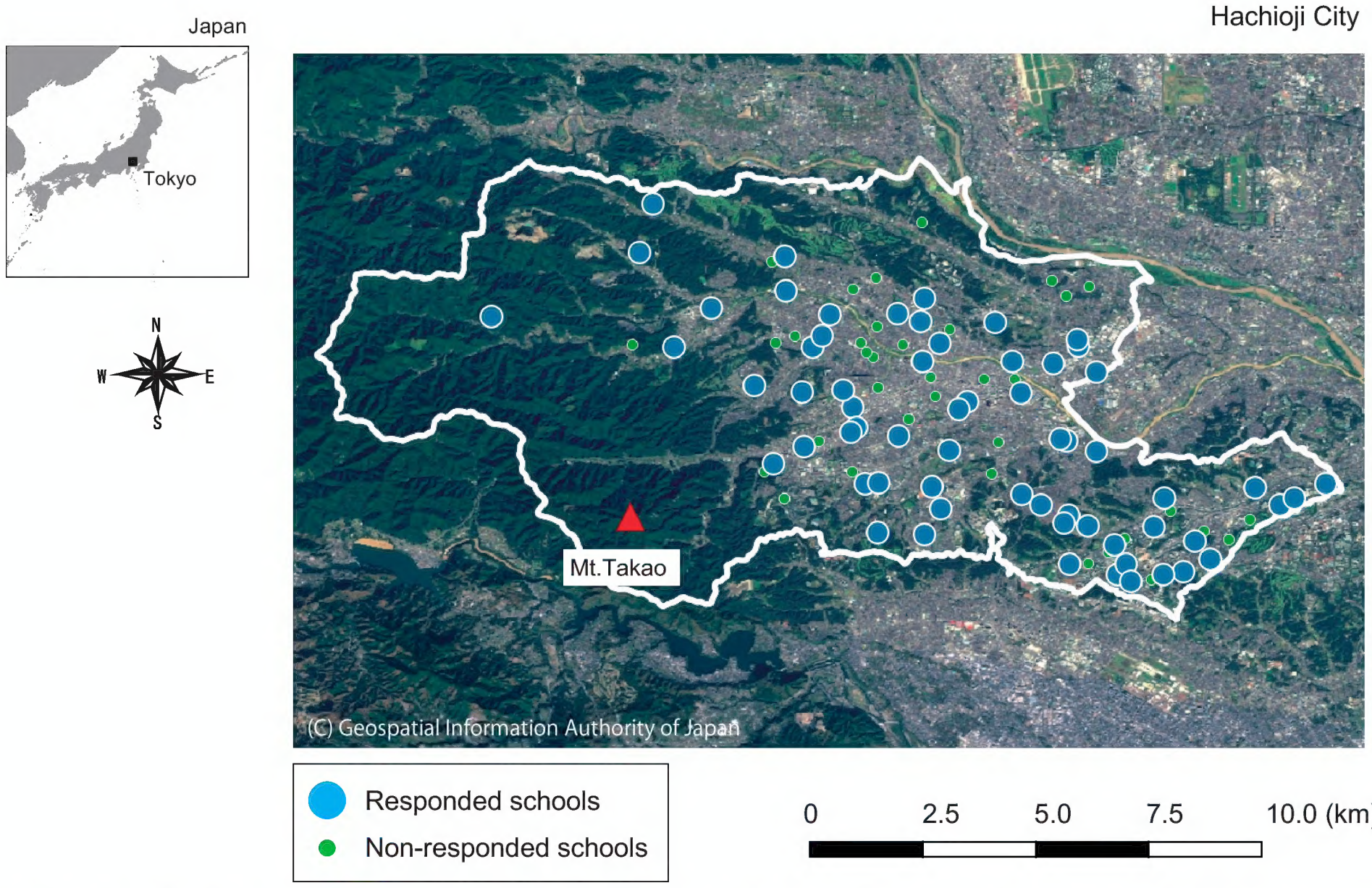

Figure 1. Distribution map of elementary and junior high schools in Hachioji City, and those that responded to the questionnaire.

environment is more likely to be reflected in the lyrics of school songs, and accordingly focused on public elementary and junior high schools.

In Hachioji City, there are 67 public elementary schools, 35 public junior high schools, and two integrated elementary-junior high schools (https://www.city.hachioji.tokyo.jp/kurashi/kyoiku/003/010/001/index.html, accessed 25, Sep., 2025). For integrated schools, if the elementary and junior high divisions had distinct school songs, they were counted separately as an elementary school and a junior high school, respectively.

Collection of school songs and keyword extraction

School songs were collected from the official websites of the respective schools. For all schools examined in this study, the school song lyrics were available on their websites. As explicitly indicated by the name of Hachioji City's official tourism portal, "Let's go to HACHIOJI, TAKAOSAN" (https://www.hkc.or.jp/en/, accessed 25, Sep., 2025), the mountainous area centered on Mt. Takao serves as a key ecosystem. Accordingly, we extracted explicit references to Mt. Takao, as well as words considered to denote mountains in general, from school songs. The specific terms are presented in Table 1.

Collection of information on educational programs via questionnaire

To obtain information on nature-related educational programs conducted at each school, we conducted a questionnaire survey between Aug. 4 and

Table 1. Number of terms included in school songs. Because all lyrics were in Japanese, the search terms are presented in Japanese with their English meanings in parentheses. Values represent means ± standard deviations.

Mountain related terms	Total Count (n = 63)	Average number
高尾 (Mt. Takao)	7	0.11 ± 0.32
山 (Mountain)	14	0.22 ± 0.42
峰 (Peak)	15	0.24 ± 0.43
ふもと (Base of the mountain)	3	0.05 ± 0.21
高台 (Elevated area)	1	0.02 ± 0.13
丘陵 (Hill range)	8	0.12 ± 0.34
Presence/absence of mountain-related terms	30	0.49 ± 0.50
Number of mountain-related terms in each school	-	0.67 ± 0.78

Table 2. Presence/absence of nature-related educational activities based on questionnaire responses. Values represent both actual counts and average ± standard deviations.

Question	Total counts (n = 63)	Average number
Nature-based outdoor school program	29	0.46 ± 0.50
Activities with local nature conservation organizations	3	0.48 ± 0.21
Use of nearby green spaces	42	0.67 ± 0.48

Sep. 7, 2021. Initial requests were made by telephone, and for schools that agreed to participate, questionnaires were distributed via e-mail, fax, or postal mail, and responses were collected through the same channels. The questionnaire was administered at the school level and did not collect any personally identifiable information, responses were anonymous; therefore, ethical approval and informed consent were not required. The questionnaire items are presented in Table 2. The items were as follows: 1) presence/absence of nature-based outdoor school programs as a school event, 2) presence/absence of school participation in activities of local nature conservation organizations, and 3) presence/absence of the use of nearby green spaces in educational activities. All items were designed as yes/no questions. Because the questionnaire items were very simple, we did not conduct a pilot survey to verify the reliability of the responses. Considering that many outdoor events such as excursions had been canceled due to the COVID-19 pandemic, respondents were asked to report the situation as it was before FY2018. It should be noted that the questionnaire included a total of 15 items; however, only a subset was examined in this study. The items examined in this study were not influenced by the other questionnaire items.

Analysis of the relationship between school song lyrics and educational programs

To test the relationship between the presence/absence of nature-related educational activities reported in the questionnaire and the keywords included in the school-song lyrics, we fitted generalized linear models (GLMs) with a binomial error distribution (logit link) and assessed statistical significance using Wald tests. The dependent variables were 0/1 data corresponding to items 1) presence/absence of nature-based outdoor school programs as a school event, 2) presence/absence of school participation in activities of local nature conservation organizations, and 3) presence/absence of the use of nearby green spaces in educational activities.

The explanatory variables included (i) a 0/1 variable indicating whether the school song contained the term "Takao," and (ii) a variable indicating whether the song contained any word referring to mountains or the number of mountain-related words contained in the lyrics. Wald tests were used to identify the factors that significantly influenced each school's activity. All statistical analyses were performed using R software (ver. 4.5.0; https://www.r-project.org/, accessed 25, Sep., 2025).

Results

Regarding school song collection, all 104 schools targeted in this study had their songs posted on their official websites. For the questionnaire survey, we obtained responses from 63 of the 104 schools, yielding a response rate of 60.6%, and all responses were valid (Fig. 1). Therefore, keyword count and educational program analyses were conducted using data from these 63 schools.

Among the 63 school songs, seven contained the term "Takao" (Table 1). Regarding mountain-related words, "山" (mountain) and "峰" (peak) were relatively common, appearing in the songs of 14 and 15 schools, respectively (Table 1), respectively. In contrast, "高台" (elevated area) was found in only one school song. In total, 30 school songs contained at least one of the five mountain-related terms (Table 1).

According to the questionnaire survey, nature-based outdoor school programs were implemented in 29 schools, and 42 schools reported using local green spaces for their educational activities (Table 2). In contrast, only three schools participated in the activities of local nature conservation organizations (Table 2); therefore, this item could not be subjected to statistical analysis.

GLM analysis revealed no significant relationship between the presence of specific words in school songs and the implementation of nature-based outdoor school programs (Table 3). In contrast, both the presence and number of mountain-related words in school songs were significantly and positively associated with the use of local green spaces (Table 3). Although the model including the presence/absence of mountain-related words yielded a lower AIC value, the difference was minimal (Table 3).

Discussion

In this study, we combined a keyword analysis of school-song lyrics with questionnaire responses on nature-related educational activities. We found that schools whose songs included mountain-related references were more likely

Table 3. Results of generalized linear models (GLMs) using the presence/absence of each nature-related educational activity as the response variable and the presence/absence or number of terms as explanatory variables. Asterisks indicate significance based on the Wald test. Significant variables were shown in bold-italic.

Explanatory variables	Nature-based outdoor school program		Use of nearby green spaces	
Term "Takao"	-0.62 ± 0.90	-0.72 ± 0.896	-0.08 ± 0.93	-0.05 ± 0.91
Included mountain related term	-0.94 ± 0.53	-	***1.21 ± 0.58 ****	-
Number of included mountain related terms	-	-0.64 ± 0.34	-	***0.77 ± 0.42 ****
Intercept	0.34 ± 0.36	0.31 ± 0.34	0.19 ± 0.35	0.25 ± 0.35
AIC	88.68	88.48	81.49	82.01

Results of wald test, *: p < 0.05: **: p < 0.01, ***: p < 0.001.

to engage in nature-related activities in nearby green spaces. This finding suggests a potential link between symbolic cultural representations embedded in school traditions and the actual practice of nature-related education.

Among the 63 elementary and junior high schools examined, seven school songs explicitly contained the term “Takao”. Also, approximately half of the schools included mountain-related terms in their school songs. This pattern reflects the importance of mountains in Hachioji city, as indicated on the official city website. However, statistical analyses showed that the inclusion of the term “Takao” in school songs was not associated with nature-related educational activities. In contrast, the presence of mountain-related terms in school songs was positively correlated with nearby green space use. Notably, no such relationship was observed with nature-based outdoor school programs. One possible interpretation of this result is the distance to the location where the activity takes place. In general, nature-based outdoor school programs involve overnight activities in more distant natural settings. Therefore, their implementation may not be influenced by local place attachment. These results highlight the role of cultural ecosystem services (CES) in shaping human-nearby nature interactions. Wang et al. (2025) demonstrated that folk music reflects the natural conditions (mountain ranges, terrain, and rivers) of their regions, suggesting that music and songs act as carriers of local ecological identity (Wang et al. 2025). In addition, a previous study has shown the positive effect of place attachment on environmental behavior in a wide variety of contexts (Daryanto and Song 2021; Kuo et al. 2021). This study extends this line of evidence by demonstrating that cultural symbols institutionalized in school songs are associated with tangible behavioral outcomes in educational settings. The recurrent singing of songs that reference local mountains may reinforce the symbolic importance of these landscapes, thereby motivating schools to incorporate surrounding ecosystems into their curricular and extracurricular activities and increase conservation consciousness of students.

Active utilization of locally available ecosystems in education can also contribute to fostering a broader awareness of environmental conservation that extends beyond the immediate locality. It is well established that the richness of childhood experiences in nature exerts a strong influence on environmental awareness (Soga and Gaston 2016). Giusti et al. (2025) demonstrated that schools located in ecologically rich settings or with curricula emphasizing nature are more likely to produce students with stronger nature connection and outdoor engagement (Giusti et al. 2025). These imply that song/lyrical content tied to natural features is not merely decorative but relates to fostering behavior choices consistent with those environments.

Limitation and conclusion

Nevertheless, several limitations of this study should be acknowledged. First, the analysis focused on the presence of mountain related keywords, which may not capture the full diversity of cultural and ecological references contained in school songs. Future studies should expand the scope to include other natural features, such as rivers, forests, and species of local significance. Second, while the observed association suggests a cultural influence on behavior, the causal mechanisms remain to be clarified; it is possible that both the creation of lyrics and the

design of outdoor programs reflect broader community values related to nature. Longitudinal or qualitative approaches could help disentangle these dynamics.

This study provides novel evidence that cultural ecosystem services, expressed through symbolic and place representations in school songs, can influence actual patterns of behavior. Results demonstrated that cultural values embedded in ordinal educational practices are linked to outdoor engagement with nearby ecosystems, our findings underscore the importance of considering cultural dimensions in both environmental education and conservation planning.

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Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

This study did not involve human participants. The survey was conducted at the organizational level (public schools) and focused on institutional activities rather than individual opinions or behaviors. The definition of "human participant" is in accordance with the Research Ethics Regulations of Tokyo Metropolitan University (東京都立大学研究倫理委員会規程, https://www1.g-reiki.net/tmu/reiki_honbun/u430RG00000186.html, accessed 14, Oct., 2025) and the Ethical Guidelines of Tokyo Metropolitan University Arakawa Campus (東京都立大学荒川キャンパス研究倫理の指針, 2025 version, https://www.hs.tmu.ac.jp/extra/download.html?d=assets%2Ffiles%2Fdownload%2F1796%2Fshishin_2025.pdf, accessed 14, Oct., 2025). According to the Ethical Guidelines for Life Sciences and Medical Research Involving Human Subjects (2021, Ministry of Education, Culture, Sports, Science and Technology; Ministry of Health, Labour and Welfare; Ministry of Economy, Trade and Industry, Japan, https://www.mext.go.jp/a_menu/lifescience/bioethics/seimeikagaku_igaku.html, accessed 14, Oct., 2025), "research involving human subjects" is defined as research in life sciences or medicine that involves living individuals through surveys, observations, experiments, or other actions, and uses specimens or information obtained from them. In addition, this study adhered to the ethical principles outlined in the Code of Conduct for Scientists: Revised Edition (Science Council of Japan 2013; https://www.scj.go.jp/ja/info/kohyo/pdf/kohyo-22-s168-1.pdf, accessed 14, Oct., 2025). Since the present study involved organizational-level surveys and did not collect specimens or personal information from individuals, it does not fall within the scope of this guideline. According to these institutional and national guidelines, the study was confirmed not to require formal ethical review and informed consent, as it did not involve human participants.

Use of AI

The following AI tools were used in the preparation of this manuscript:
Description: As the authors are not native English speakers, we used an AI tool for English language editing.

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Author contributions

TO conceived the study. KM contributed to the data collection, TO and KM management and processed the data set. KM wrote the first draft with critical input from TO. All authors contributed to the study and approved the final version of the article for submission.

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Data availability

Analyzed data are attached as supplemental materials. All data set out can be provided based on reasonable requests to the corresponding author.

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Supplementary material 1

Analysis code for "Cultural ecosystem services in song: Linking ecological references in school song to nature-related educational activities"

Author: Takeshi Osawa

Data type: txt

Explanation note: Code used to reproduce the statistical analyses in the manuscript. The dataset is provided in a separate file.

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Link: https://doi.org/10.3897/natureconservation.63.180492.suppl1

Supplementary material 2

Analysis data for "Cultural ecosystem services in song: Linking ecological references in school song to nature-related educational activities"

Author: Takeshi Osawa

Data type: csv

Explanation note: Dataset used in the manuscript. Some parts remain in the original Japanese. The code for statistical analyses is provided in a separate file.

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